

**REPORT NUMBER: 305-MGA-2013-005**

**SAFETY COMPLIANCE TESTING FOR FMVSS 305  
Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection**

**CODA AUTOMOTIVE  
2012 Coda All Electric 4-Dr Sedan  
NHTSA NUMBER: CC1005**

**PREPARED BY:  
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**Test Date: March 7, 2013**

**Report Date: March 22, 2013**

**FINAL REPORT**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
ENFORCEMENT  
OFFICE OF VEHICLE SAFETY COMPLIANCE  
1200 NEW JERSEY AVENUE, SE  
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WASHINGTON, DC 20590**

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### Technical Report Documentation Page

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<b>15. Supplementary Notes</b>					
<b>16. Abstract</b>  An indicant compliance test was conducted on the subject 2012 Coda All Electric 4-Dr Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-305-01 for the determination of FMVSS 305 compliance. Test failures identified were as follows:  None.					
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**SECTION 1**  
**PURPOSE OF COMPLIANCE TEST**

This electric vehicle, a 2012 Coda All Electric 4-Dr Sedan, (NHTSA No. CC1005), in conjunction with the FMVSS 201P impact, was tested to FMVSS 305.

The test was performed in accordance with the specifications of the Office of Vehicle Safety Compliance (OVSC) Test Procedure TP-305-01 to determine indicant compliance to the requirements of Federal Motor Vehicle Safety Standard (FMVSS) 305, "Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection".

Based on the test results, the 2012 Coda All Electric 4-Dr Sedan appears to meet the requirements of FMVSS 305 testing.

This program is sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-12-D-00268.

The following data sheets document the results of the FMVSS 305 test.

**TEST NOTES**

None.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

**SECTION 2**  
**DATA SHEETS**

**DATA SHEET NO. 1**  
**TEST VEHICLE SPECIFICATIONS**

Test Vehicle: 2012 Coda All Electric 4-Dr Sedan

NHTSA No. CC1005

**TEST VEHICLE INFORMATION**

Year/Make/Model/Body Style	2012 Coda All Electric 4-Dr Sedan
NHTSA No.	CC1005
Color	Black
Date Received	11/16/2012
Odometer Reading	57 km
Selling Dealer	N/A

**DATA FROM CERTIFICATION LABEL**

Manufactured By	CODA AUTOMOTIVE	GVWR (kg)	2045
Date of Manufacture	02/12	GAWR Front (kg)	995
VIN:	53G1U4A43CB000063	GAWR Rear (kg)	1050

**DATA FROM VEHICLE'S TIRE PLACARD & SIDEWALL**

Measured Parameter	Front	Rear
Location of Placard of Vehicle	Left Side B-Post	
Recommended Tire Size	205/45R17	205/45R17
Recommended Cold Tire Pressure	290 kPa	290 kPa
Size of Tires on Test Vehicle	205/45R17	205/45R17
Type of Spare Tire	None	

**VEHICLE CAPACITY DATA**

Measured Parameter	Front	Rear	Third	Total
Type of Front Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				375
Number of Occupants x 68 kg				340
Cargo Weight (RCLW) (kg)				35

**ELECTRIC VEHICLE PROPULSION SYSTEM**

Type of Electric Vehicle (Electric/Hybrid):	Electric
Electric Energy Storage/Device:	Lithium Ion
Nominal Voltage (V):	333.0 V
Physical Location of the High Voltage Source Automatic Disconnect:	Internal to Battery System
Auxiliary Battery Type:	Lead Acid Battery

**DATA SHEET 2**  
**PRE-TEST DATA**

Test Vehicle: 2012 Coda All Electric 4-Dr Sedan

NHTSA No. CC1005

**CALCULATION OF TARGET TEST WEIGHT (TTW)**

Measured Parameter	Units	Value
Unloaded Vehicle Weight (UVW)	kg	1672.9
Rated Cargo & Luggage Weight (RCLW)	kg	35
Weight of 1 P572U ATD (SID H3) Dummy	kg	80.7
<b>TARGET TEST WEIGHT</b>	kg	<b>1788.6</b>

Note: The target weight is calculated including tolerances as specified in each vehicle crash test procedure.

**TEST VEHICLE WEIGHTS**

	Units	As Delivered			Fully Loaded			As Tested		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	433.2	392.8		469.5	440.4		469.0	443.6	
Right	kg	458.1	388.8		460.4	417.8		462.2	406.5	
Ratio	%	53.3	46.7		52.0	48.0		52.3	47.7	
Totals	kg	891.3	781.6	1672.9	929.9	858.2	1788.1	931.2	850.1	1781.3

**TIRE PRESSURES**

	Units	LF	RF	RR	LR
As Delivered	kPa	290	290	290	290
As Tested	kPa	290	290	290	290



## DATA SHEET 2 (CONTINUED)

### PRE-TEST DATA

#### ELECTRIC ENERGY STORAGE CONVERSION/DEVICE SYSTEM DATA (COTR SUPPLIED DATA)

Electrolyte Fluid Type:	EC/DEC/LiPF6	
Electrolyte Fluid Specific Gravity:	No Free Electrolyte	
Electrolyte Kinematic Viscosity (centistokes):	No Free Electrolyte	
Electrolyte Fluid Color:	Colorless	
Electric Energy Storage/Conversion System Coolant Type, Color, Specific Gravity (if applicable):	Air	
Location of Battery Modules:		Inside Passenger Compartment
	X	Outside Passenger Compartment
	The high voltage battery is mounted underneath the vehicle.	
Electric Energy Storage/Conversion System State of Charge:	X	Maximum State of Charge
		Range of Normal Operating Voltage
Maximum State of Charge	385.0 V	
Test Voltage - No less than 95% of maximum State of Charge:	346.6 V	
Range of Normal Operating Voltage:		
Test Voltage – Within Normal Operative Voltage Range:		
Test Vehicle Equipped with Electrical Isolation Monitoring	The EV system has an isolation monitoring system. The manufacturer indicates that it illuminates an isolation light on the instrument cluster.	

#### VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Location(s)	In cargo area, attached to 12V chassis ground.
--	--

#### ELECTRIC ENERGY STORAGE/CONVERSION TEST POINTS

Details of Electric Energy Storage/Conversion System Test Points:	The positive and negative test points to the battery are accessible in the trunk by removing the decking and foam protection. Attachment is then implemented at the High Voltage (HV) distribution box connector.
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### DATA SHEET 3

#### PRE-IMPACT ELECTRIC ISOLATION MEASUREMENTS & CALCULATIONS

Test Vehicle: 2012 Coda All Electric 4-Dr Sedan

NHTSA No. CC1005

#### VOLTMETER INFORMATION

Make:	Fluke
Model:	11
Serial Number:	68541805
Internal Impedance Value (M $\Omega$ ):	> 10 M $\Omega$ < 100 pF
Resolution (V):	.001 Volts
Last Calibration Date:	12/17/2012

#### ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM VOLTAGE

Measurement shall be made with Energy Storage/Conversion System connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion system energized) position.

If voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.

Vb (V):	346.6
---------	-------

#### ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM TO VEHICLE CHASSIS

Vehicle chassis point(s) determined and supplied to contractor by COTR.

V1 (V):	112.1
V2 (V):	113.6

#### ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM TO VEHICLE CHASSIS ACROSS RESISTOR

The known resistance Ro (in ohms) should be approximately 500 times the normal operating voltage of the vehicle (in volts) per SAE J1766.

Ro ( $\Omega$ ):	179800
------------------	--------

### DATA SHEET 3 (CONTINUED)

#### PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS

##### ELECTRICAL ISOLATION MEASUREMENT

Note: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

V1' (V):	21.9
$R_{i1} = R_o (1 + V_2/V_1) [(V_1 - V_1')/V_1']$	
Ri1 (Ω):	1491001
V2' (V):	22.3
$R_{i2} = R_o (1 + V_1/V_2) [(V_2 - V_2')/V_2']$	
Ri2 (Ω):	1462544
Ri = The lesser of Ri1 and Ri2	
Ri Pre-Test ((Ω):	1462544
Ri/Vb (Ω/V):	4220
Minimum Electrical Isolation Value is 500 Ω/V	

Note: Measurements completed within 15 minutes prior to impact.

Is the measured Electrical Isolation Value:	Yes, Pass	No, Fail
$\geq 500 \Omega/V$ without electrical isolation monitoring	X	
$\geq 100 \Omega/V$ with electrical isolation monitoring		

**DATA SHEET 4**  
**POST-IMPACT DATA**

Test Vehicle: 2012 Coda All Electric 4-Dr Sedan

NHTSA No. CC1005

**VOLTMETER INFORMATION**

Make:	Fluke
Model:	11
Serial Number:	68541805
Internal Impedance Value (MΩ):	> 10 MΩ < 100 pF
Nominal Propulsion Battery Voltage (Vb) (V):	346.6
Resolution (V):	0.001
NOTE: Record V1, V2, V1', V2' voltage measurements at a minimum of 5 seconds after impact.	

**ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM  
VOLTAGE LOCATION OF MEASUREMENT**

Measurement is made from the side of the automatic disconnect connected to the electric powertrain.

Vb (V):	0.5 V
---------	-------

**ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM VOLTAGE**

V1 =	0.50	V	Impact Time:	0	Minutes	26	s
V2 =	0.20	V	Impact Time:	0	Minutes	33	s
V1' =	0.02	V	Impact Time:	0	Minutes	58	s
V2' =	0.02	V	Impact Time:	1	Minutes	2	s

**ELECTRICAL ISOLATION MEASUREMENT**

Note: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

$R_{i1} = R_o (1 + V_2/V_1) [(V_1 - V_1')/V_1']$							
Ri1 =	6041280	Ω	Impact Time:	0	Minutes	26	s
$R_{i2} = R_o (1 + V_1/V_2) [(V_2 - V_2')/V_2']$							
Ri2 =	5663700	Ω	Impact Time:	0	Minutes	33	s
Ri = The lesser of Ri1 and Ri2							
Ri =	5663700	Ω	Impact Time:	0	Minutes	46	s
Ri/Vb = electrical Isolation Value/Nominal Battery Voltage							
Minimum Electrical Value is 500 Ω/V							
Ri/Vb =	16341	Ω/V	Impact Time:	0	Minutes	46	s

Is the measured Electrical Isolation Value:	Yes, Pass	No, Fail
≥500 Ω/V without electrical isolation monitoring	X	
≥100 Ω/V with electrical isolation monitoring		

## DATA SHEET 4 (CONTINUED)

### POST-IMPACT DATA

#### ELECTRIC ENERGY STORAGE/CONVERSION DEVICE

	Inside Passenger Compartment	Outside Passenger Compartment
Location of Electric Energy Storage/Conversion Device:		X

	Yes, Pass	No, Fail
All Components of Electrical Energy Storage/Conversion Device remained attached to the vehicle with at least one mounting location.	X	

Describe Electric Energy Storage/Conversion Device movement within the passenger compartment [Supply photographs as appropriate]:
Not Applicable

	Yes, Fail	No, Pass
Has the Electric Energy Storage/Conversion Device moved within the passenger compartment?		X

Describe intrusion of an outside Electric Energy Storage/Conversion Device into the passenger compartment [Supply photographs as appropriate]:
No Movement

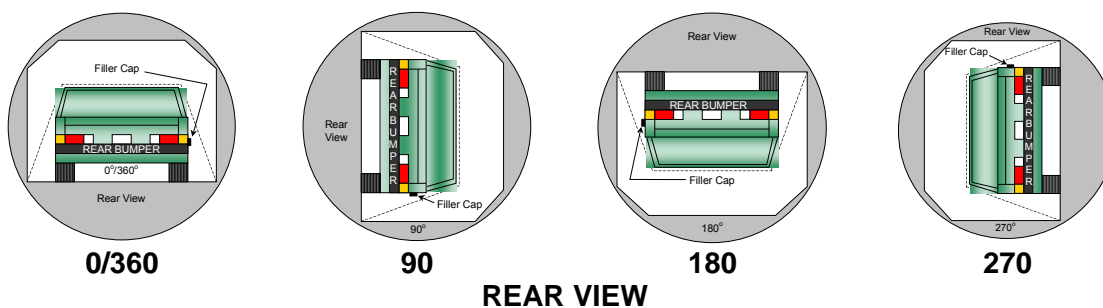
	Yes, Fail	No, Pass
Has an outside Electric Energy Storage/Conversion Device intruded into the passenger compartment?		X

	Yes, Fail	No, Pass
Is Electric Energy Storage/Conversion Device electrolyte spillage visible in the passenger compartment?		X

# **DATA SHEET 5** **STATIC ROLLOVER TEST DATA**

Test Vehicle: 2012 Coda All Electric 4-Dr Sedan

NHTSA No. CC1005



## **DETERMINATION OF ELECTRIC ENERGY STORAGE/CONVERSION DEVICE ELECTROLYTE COLLECTION TIME PERIOD**

Rollover Stage	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	2	minutes	54	seconds	5	minutes	7	minutes	54	seconds	8	minutes
90° - 180°	2	minutes	37	seconds	5	minutes	7	minutes	37	seconds	8	minutes
180° - 270°	2	minutes	17	seconds	5	minutes	7	minutes	17	seconds	8	minutes
270° - 360°	2	minutes	43	seconds	5	minutes	7	minutes	43	seconds	8	minutes

## **ACTUAL TEST VEHICLE ELECTRIC ENERGY STORAGE/CONVERSION DEVICE ELECTROLYTE SPILLAGE**

Rollover Stage	Electric Energy Storage/Conversion Device Electrolyte Spillage (L)	Spillage Location
0° to 90°	0	Not Applicable
90° to 180°	0	Not Applicable
180° to 270°	0	Not Applicable
270° to 360°	0	Not Applicable

Total Spillage: 0 L

	Yes, Fail	No, Pass
Is the total spillage of Electric Energy Storage/Conversion Device electrolyte greater than 5.0 Liters?		X
Is Electric Energy Storage/Conversion Device electrolyte spillage visible in the passenger compartment?		X

**DATA SHEET 5 (CONTINUED)**  
**STATIC ROLLOVER TEST DATA**

Test Vehicle: 2012 Coda All Electric 4-Dr Sedan

NHTSA No. CC1005

**VOLTMETER INFORMATION**

Make:	Fluke
Model:	11
Serial Number:	68541805
Internal Impedance Value (MΩ):	> 10 MΩ < 100 pF
Nominal Electric Energy Storage/Conversion Device Voltage (Vb) (V):	346.6
Record V1, V2, V1', V2' voltage measurements at the start of each successive increment of 90°, 180°, 270°, and 360° of the static rollover test.	

**ELECTRICAL ISOLATION MEASUREMENT**

V1 =	0.00	V	0°	Time:		Minutes		s
V1 =	0.00	V	90°	Time:	3	Minutes	5	s
V1 =	0.00	V	180°	Time:	0	Minutes	39	s
V1 =	0.00	V	270°	Time:	0	Minutes	42	s
V1 =	0.00	V	360°	Time:	0	Minutes	39	s
V2 =	0.00	V	0°	Time:		Minutes		s
V2 =	0.00	V	90°	Time:	3	Minutes	11	s
V2 =	0.00	V	180°	Time:	0	Minutes	43	s
V2 =	0.00	V	270°	Time:	0	Minutes	46	s
V2 =	0.00	V	360°	Time:	0	Minutes	42	s
V1' =	0.00	V	0°	Time:		Minutes		s
V1' =	0.00	V	90°	Time:	3	Minutes	17	s
V1' =	0.00	V	180°	Time:	1	Minutes	0	s
V1' =	0.00	V	270°	Time:	0	Minutes	52	s
V1' =	0.00	V	360°	Time:	0	Minutes	55	s
V2' =	0.00	V	0°	Time:		Minutes		s
V2' =	0.00	V	90°	Time:	3	Minutes	25	s
V2' =	0.00	V	180°	Time:	0	Minutes	53	s
V2' =	0.00	V	270°	Time:	0	Minutes	58	s
V2' =	0.00	V	360°	Time:	0	Minutes	47	s
Vb =	0.10	V	0°	Time:		Minutes		s
Vb =	0.00	V	90°	Time:	3	Minutes	0	s
Vb =	0.00	V	180°	Time:	0	Minutes	34	s
Vb =	0.00	V	270°	Time:	0	Minutes	35	s
Vb =	0.00	V	360°	Time:	0	Minutes	35	s

**DATA SHEET 5 (CONTINUED)**  
**STATIC ROLLOVER TEST DATA**

Test Vehicle: 2012 Coda All Electric 4-Dr Sedan

NHTSA No. CC1005

**ELECTRICAL ISOLATION CALCULATION**

Note: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

$R_{i1} = R_o (1 + V_2/V_1) [(V_1 - V_1')/V_1']$								
R <sub>i1</sub> =	Zero Volts	Ω	0°	Time:		Minutes		s
R <sub>i1</sub> =	Zero Volts	Ω	90°	Time:	3	Minutes	5	s
R <sub>i1</sub> =	Zero Volts	Ω	180°	Time:	0	Minutes	39	s
R <sub>i1</sub> =	Zero Volts	Ω	270°	Time:	0	Minutes	42	s
R <sub>i1</sub> =	Zero Volts	Ω	360°	Time:	0	Minutes	39	s
$R_{i2} = R_o (1 + V_1/V_2) [(V_2 - V_2')/V_2']$								
R <sub>i2</sub> =	Zero Volts	Ω	0°	Time:		Minutes		s
R <sub>i2</sub> =	Zero Volts	Ω	90°	Time:	3	Minutes	11	s
R <sub>i2</sub> =	Zero Volts	Ω	180°	Time:	0	Minutes	43	s
R <sub>i2</sub> =	Zero Volts	Ω	270°	Time:	0	Minutes	46	s
R <sub>i2</sub> =	Zero Volts	Ω	360°	Time:	0	Minutes	42	s
R <sub>i</sub> = The lesser of R <sub>i1</sub> and R <sub>i2</sub>								
R <sub>i</sub> =	Zero Volts	Ω	0°	Time:		Minutes		s
R <sub>i</sub> =	Zero Volts	Ω	90°	Time:	3	Minutes	5	s
R <sub>i</sub> =	Zero Volts	Ω	180°	Time:	0	Minutes	39	s
R <sub>i</sub> =	Zero Volts	Ω	270°	Time:	0	Minutes	42	s
R <sub>i</sub> =	Zero Volts	Ω	360°	Time:	0	Minutes	39	s
R <sub>i</sub> /V <sub>b</sub> = Electrical Isolation Value/Nominal Battery Voltage Minimum Electrical Isolation Value is 500 Ω /V								
R <sub>i</sub> /V <sub>b</sub> =	Zero Volts	Ω/V	0°	Time:		Minutes		s
R <sub>i</sub> /V <sub>b</sub> =	Zero Volts	Ω/V	90°	Time:	3	Minutes	5	s
R <sub>i</sub> /V <sub>b</sub> =	Zero Volts	Ω/V	180°	Time:	0	Minutes	39	s
R <sub>i</sub> /V <sub>b</sub> =	Zero Volts	Ω/V	270°	Time:	0	Minutes	42	s
R <sub>i</sub> /V <sub>b</sub> =	Zero Volts	Ω/V	360°	Time:	0	Minutes	39	s

Is the measured Electrical Isolation Value:	Yes, Pass	No, Fail
≥500 Ω/V without electrical isolation monitoring	X	
≥100 Ω/V with electrical isolation monitoring		



**APPENDIX A**  
**PHOTOGRAPHS**

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Pre-Impact View of Electric Propulsion Drive



Post-Impact View of Electric Propulsion Drive





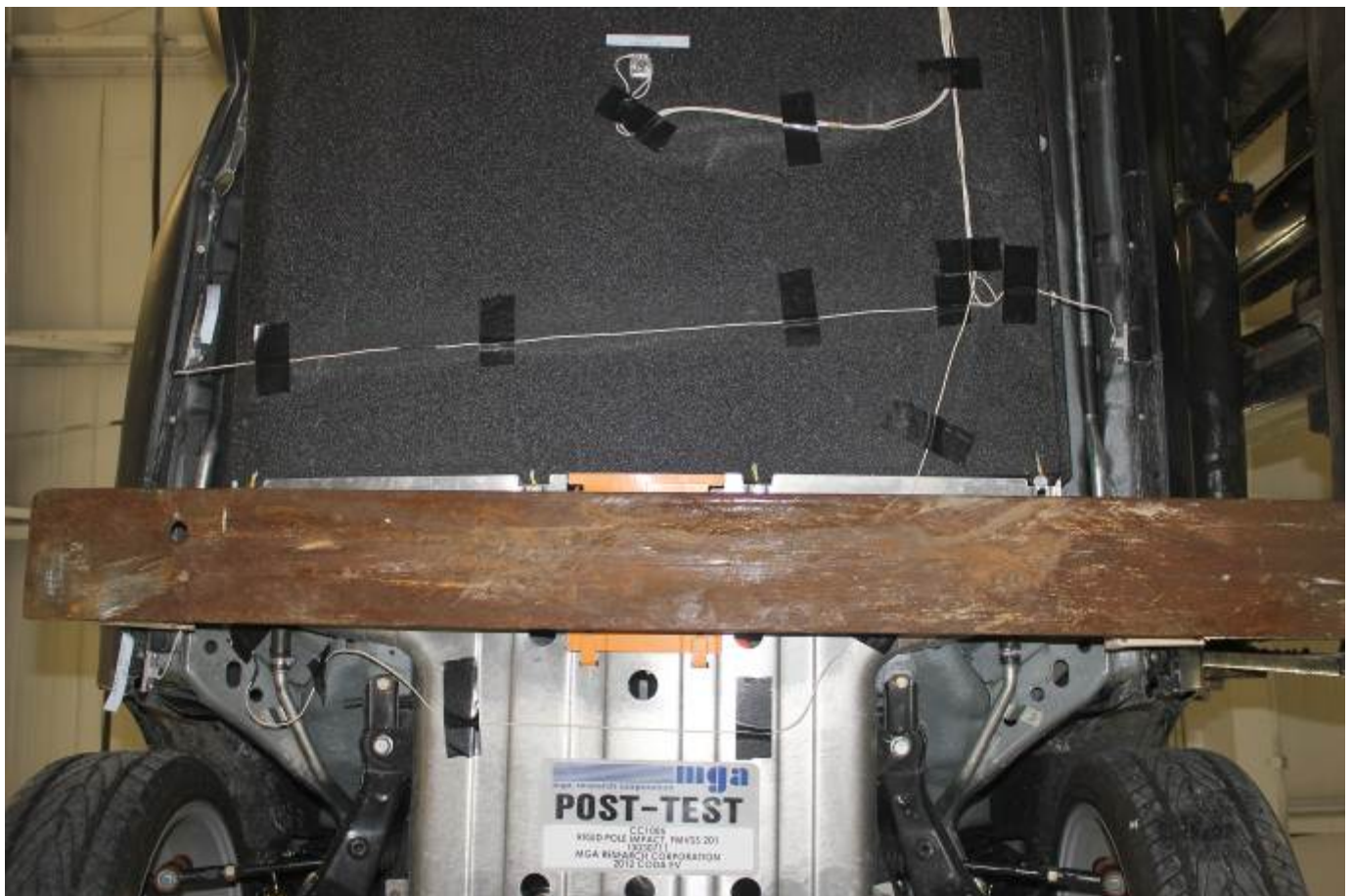
Pre-Impact View of Electric Propulsion Drive



Post-Impact View of Electric Propulsion Drive



Pre-Impact View of Propulsion Battery



Post-Impact View of Propulsion Battery





Pre-Impact View of Propulsion Battery



Post-Impact View of Propulsion Battery





Pre-Impact View of Propulsion Battery



Post-Impact View of Propulsion Battery

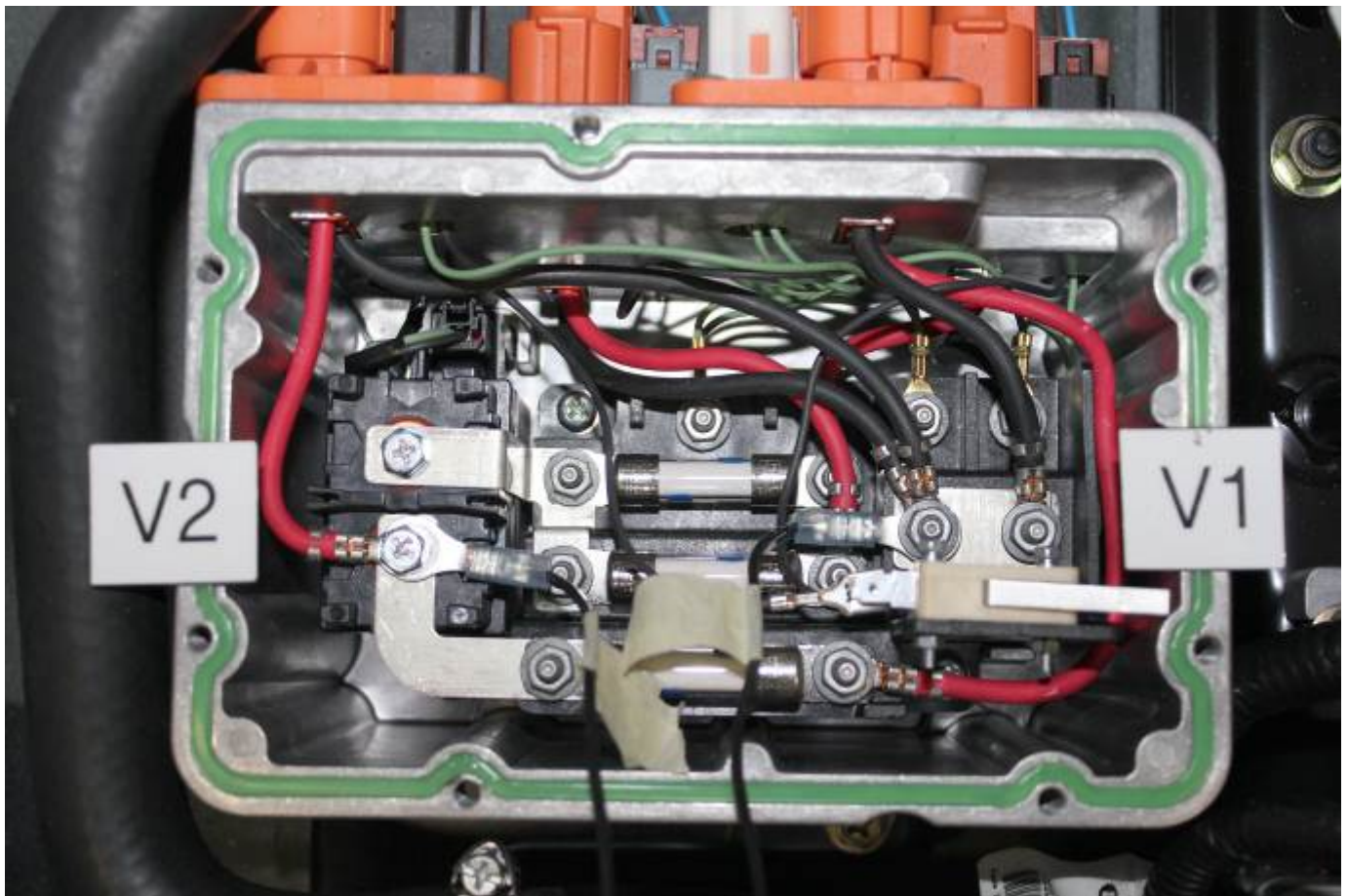


Pre-Impact View of Passenger Compartment



Post-Impact View of Passenger Compartment





Pre-Impact View of High Voltage Lead Attached



Pre-Impact View of Ground Lead Attached





Pre-Impact View of Installed Impact Interface Port



Post-Impact View of Installed Impact Interface Port





FMVSS No. 305 Static Rollover at 90°



FMVSS No. 305 Static Rollover at 180°





FMVSS No. 305 Static Rollover at 270°



FMVSS No. 305 Static Rollover at 360°





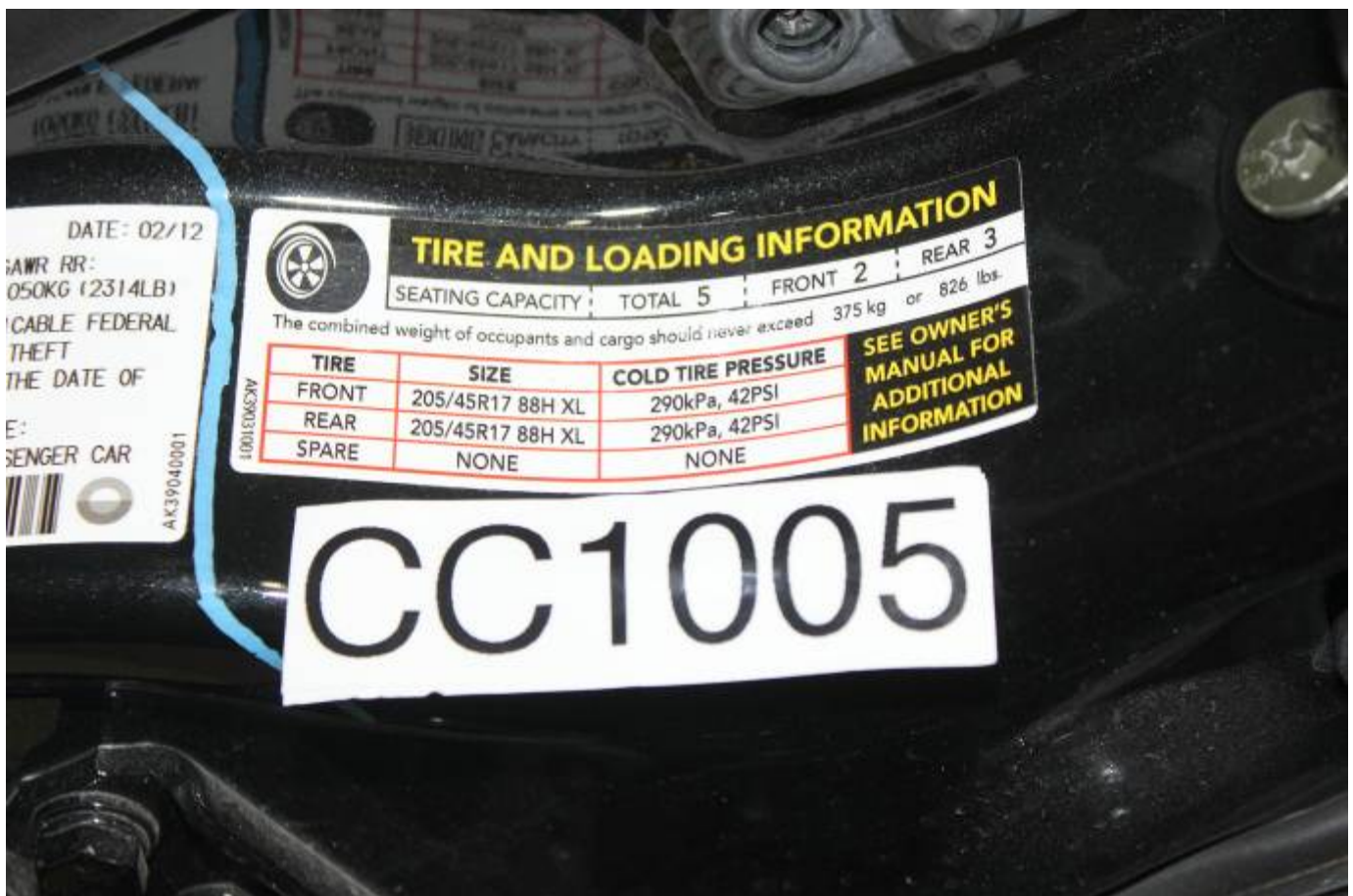
As Delivered Right Front  $\frac{3}{4}$  View of Impact Vehicle



As Delivered Left Rear  $\frac{3}{4}$  View of Impact Vehicle



Vehicle's Certification Label



Vehicle's Tire Information Placard or Label